METHOD OF CHANGING PROGRAM OF REMOTE NODE IN NETWORK

CLAIM OF PRIORITY

This application makes reference to and claims all benefits accruing under 35 U.S.C. Section 119 from an application for METHOD OF CHANGING PROGRAM OF REMOTE NODE IN NETWORK filed earlier in the Korean Industrial Property Office on July 14, 1999 and there duly assigned Serial No. 28561/1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method for changing the program of each transmission system constituting a network, and more particularly to a method for changing the program of each transmission system in a remote place.

2. Description of the Related Art

In general, a communication network basically includes a plurality of nodes with a switching function being connected via transmission paths to communication terminals. A group of systems is configured in such a manner to build a network. This network includes an exchange network allowing a plurality of switching systems to be connected to each other, a transmission network allowing a plurality of transmission systems to be connected to each other, a network allowing a plurality of external terminals such as personal computers (PCs)

to be connected to each other within a specific region via a local area network (LAN), and an Internet network allowing a plurality of remote computers to be accessed to communicate with each other over the Internet.

In building a network as mentioned above, the network is classified into a variety of types depending on the characteristics of the networks. The name of the networks also varies based on the constituting elements of each of the networks. Further, the network is configured in such a manner that a network management system for the maintenance and repair of network is provided to centrally control these networks. The scope of the network is represented by a combination of nodes and links representing a network topology. There are two types of methods in implementing a network: (1) a method for implementing a network by using a loop-shaped network topology; and, (2) a method for implementing a network by using a linear-shaped network topology.

FIG. 1 is a schematic view illustrating the flow stream of data and control signals for changing the program in the loop-shaped transmission network according to the prior art.

A process for changing the program in the loop-shaped transmission network will be described in detail hereinafter with reference to FIG. 1. In FIG.1, each of transmission systems constituting the transmission network forms one node, respectively. Namely, a transmission system, i.e., a Network Element 1 (hereinafter referred as "NE 1 (21)") forming a first node is connected to a transmission system, i.e., a Network Element 2 (hereinafter

referred as "NE 2 (22)") forming a second western node. The NE 1 is connected to a transmission system, i.e., a Network Element 3 (hereinafter referred as "NE 3 (23)") forming a third eastern node. Also, a transmission system, i.e., a Network Element 4 (hereinafter referred as "NE 4 (24)") forming a fourth northern node is coupled between the NE 2 (22) and NE 3 (23). A Network Management System 10 (hereinafter referred as "NMS") is connected to the NE 1 (21).

According to the above configuration, if the NMS 10 attempts to change the program for each of the nodes (21), (22), (23), and (24) arranged in the loop-shaped transmission network, the program of the NE 1 (21) is changed first. To this end, the NMS 10 transmits a control signal, indicated by a dotted line in FIG. 1, and the new program to the NE 1 (21). After the program of the NE 1 (21) is changed into the new program transmitted from the NMS 10. The NMS 10 transmits the new program and the control signal to the NE 2 (22) via the NE 1 (21), so that the program of the NE 2 (22) can be also changed to the new program. Similarly, the NMS 10 transmits the new program and the control signal to the NE 3 (23) via the NE 1 (21), so that the program of the NE 3 (23) is changed into the new program. Then, the NMS 10 transmits the new program data and the control signal to the NE 4 (24) via the NE 1 (21) and the NE 2 (22), or the NE 1 (21) and the NE 3 (23) so that the program of the NE 4 (24) is changed into the new program.

Accordingly, if data representing the new changing program is transmitted to each of the nodes (21), (22), (23) and (24), a great deal of traffic for the data transmission of the new

changing program and the control signal is generated between the NMS 10 and the NE 1 (21), between the NE 1 (21) and the NE 2 (22), or between the NE 1 (21) and the NE 3 (23). Thus, the number of traffic hops for each of the nodes in the loop-shaped transmission network can be expressed by the following [formula 1]:

[formula 1]

$H = (N + 3) \times N + 1$, (if N is an odd number);

$H = (N + 2) \times N$, (if N is an even number),

wherein H is the number of traffic hops and N is the number of nodes (transmission systems) arranged in the loop-shaped transmission network. As the number of nodes increases, the number of traffic hops also increases, thereby degrading the transmission efficiency in the loop-shaped transmission network.

FIG. 2 is a schematic view illustrating the flow stream of data and control signals for changing the program in a linear-shaped transmission network according to the prior art.

A process for changing the program in the linear-shaped transmission network will be described in detail hereinafter with reference to FIG. 2. In FIG. 2, an NMS 10 is connected to a transmission system, i.e., NE 1 (21) forming a first node, which is connected to a transmission system, i.e., NE 2 (22) forming a second node, which is also connected to a transmission system, i.e., NE 3 (23) forming a third node. In the event that the NMS 10 attempts to change the program of each of the nodes (21), (22), (23) and (24) arranged in the

linear-shaped transmission network, the program of the NE 1 (21) first should be changed. Thus, the NMS 10 transmits the control signal, indicated by a dotted line in FIG. 2, along with data representing the new program to the NE 1 (21). In this manner, after the program of the NE 1 (21) is changed to the new program data transmitted from the NMS 10, the NMS 10 transmits the new program data and the control signal to the NE 2 (22) via the NE 1 (21), so that the program of the NE 2 (22) is also changed to the new program. Similarly, the NMS 10 transmits the new program data and the control signal to the NE 3 (23) via the NE 1 (21) and the NE 2 (22), so that the program of the NE 3 (23) is changed to the new program. Through this process, the program of transmission system forming each node is changed to the new program. Accordingly, the number of traffic hops of the nodes of the linear-shaped transmission network can be expressed by the following [formula 1]:

[formula 1]

$$H = \frac{\{N + (N+1)\}}{2}$$

wherein H is the number of traffic hops, and N is the number of nodes (transmission systems) arranged in the linear-shaped transmission network. Therefore, as the number of nodes increases as in the case of loop-shaped transmission network, the number of traffic hops increases, thereby degrading transmission efficiency in the linear-shaped transmission network.

The networking architecture arranged in the loop-shaped transmission network and linear-shaped transmission network as mentioned-above is configured in such a manner that,

if the NMS 10 attempts to change the program of each of the nodes (21), (22), (23), and (24) constituting the transmission network in a remote place, the NMS 10 centrally transmits the new program data and the control signal to each node, resulting in an increase in the number of traffic hops and thereby degrading the transmission efficiency in the transmission networks.

SUMMARY OF THE INVENTION

Therefore, an object of the invention is to provide a method for changing the program of each transmission system or node constituting a network by arranging the traffic flow to reduce the number of traffic hops, so that the time required for changing the program of each transmission system within the network can be reduced.

In accordance with the embodiment of the present invention, the present invention provides a method for changing the program of each node constituting a network in a remote place, wherein the network including at least two nodes and a network management system connected to the predetermined nodes of the network, the method comprising the steps of:

transmitting new changing program data and a control signal to the predetermined nodes connected to the network management system, wherein the predetermined node constitutes the network and the control signal being adapted to change the program of the predetermined node;

allocating a fixed region in a memory within a transmission system forming one of the predetermined nodes in response to the reception of the new changing program data and storing the new changing program data in the fixed region after changing the program of one of the predetermined node with the new changing program data under the control of the control signal;

allowing the network management system to transmit a command signal or a program-transmitting signal to one of the predetermined node and simultaneously allowing the network management system to transmit the control signal to the next predetermined node; and,

in response to the command signal or the program-transmitting signal, allowing one of the predetermined nodes to transmit the newly changing program data thereof to the next predetermined node and replacing the program of the next predetermined node with the new changing program transmitted from one of the predetermined nodes, under the control of the control signal received from the network management system.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic view illustrating the flow stream of data and control signals for changing the program in a loop-shaped transmission network in accordance with the prior art;

FIG. 2 is a schematic view illustrating the flow stream of data and control signals for changing the program in a linear-shaped transmission network in accordance with the prior art;

Figs. 3 is a schematic view illustrating the stream of data and control signals for changing the program in a loop-shaped transmission network according to the preferred embodiment of the present invention; and,

FIG. 4 is a schematic view illustrating the flow stream of data and control signals for changing the program in a linear-shaped transmission network according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A reference will now be made in greater detail to the preferred embodiments of the present invention. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. For the purpose of clarity, a detailed description of well-known functions and configurations incorporated herein will be omitted as they may make the subject matter of the present invention unclear.

Figs. 3 is a schematic view illustrating the flow stream of data and control signals for changing the program in a loop-shaped transmission network according to the preferred embodiment of the present invention.

The process for changing the program in the loop-shaped transmission network of the present invention and the flow stream of data and control signals will be described in detail hereinafter with reference to FIG. 3.

In FIG. 3, each of the transmission system constituting the transmission network forms one node, respectively. A transmission system, i.e., a Network Element 1 (hereinafter referred as "NE 1 (21)") forming a first node is connected to a transmission system, i.e., a Network Element 2 (hereinafter referred as "NE 2 (22)") forming a second western node, which is connected to a transmission system, i.e., a Network Element 3 (hereinafter referred as "NE 3 (23)") forming a third eastern node. Also, a transmission system, i.e., a Network

Element 4 (hereinafter referred as "NE 4 (24)") forming a fourth northern node is disposed between the NE 2 (22) and NE 3 (23). Further, a Network Management System 10 (hereinafter referred as "NMS") is connected to the NE 1 (21). Now, the process for changing the program in the loop-shaped transmission network of the present invention will be described in detail hereinafter with reference to FIG. 3.

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In the event that the NMS 10 attempts to change the program of each of the nodes (21), (22), (23) and (24) arranged in the loop-shaped transmission network, the program of the NE 1 (21) is initially changed. Thus, the NMS 10 transmits a new changing program data along with a control signal in order to change the program of the NE 1 (21). In the following description, the control signal transmitted from the NMS 10 to change the program of each node is referred as "a program-changing signal". When the NE 1 (21) receives the "program-changing signal" and the new changing program data from the NMS 10, the new changing program data is stored in the memory included within the NE 1 (21), then the program in the NE 1 (21) is changed under the control of the "program-changing signal" transmitted from the NMS 10. Accordingly, the program of the NE 1 (21) is changed to the new changing program data. When the program of the NE 1 (21) is changed, the NMS 10 transmits a command signal to the NE 1 (21) indicating that the NE 1 (21) should transmit the newly changed program data stored thereon to the NE 2 (22) in order to change the program of the NE 2 as well as the "program-changing signal" to the NE 2 (22). In the following description, the command signal dictating that the predetermined node, i.e., the NE 1 (21), should transmit the newly changed program data stored therein to other

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~~predetermined node, i.e., the NE 2 (22), is referred to as “a data transmitting signal”. The~~ “program-changing signal” transmitted from the NMS 10 to the NE 1 (21) is transmitted to the NE 2 (22) via the NE 1 (21). Then, the data-transmitting signal outputted from the NMS 10 is transmitted to the NE 1 (21) so that the NE 1 (21) transmits the newly changed program data stored in the memory thereof to the NE 2 (22). Through this process, the NMS 10 can change the program data of the NE 2 (22) using the newly changed program data stored in the memory of the NE 1 (21). That is, the newly changed program data stored in the memory of the NE 1 (21) is directly transmitted to the NE 2 (22), instead of being transmitted from the NMS 10 to the NE2 (22) via the NE 1 (21) as in the prior art, thereby reducing the number of the traffic hops. For the NE 3 (23) and the NE 4 (24), the process of changing program data of the NE 3 (23) and the NE 4 (24) can also be performed through the above-mentioned process. Accordingly, when the program of the transmission system forming each node is changed to the new changing program data as explain above, the number of traffic hops of the nodes arranged in the loop-shaped transmission network can be expressed by the ~~following [formula 3]:~~

[formula 3]

$H = N + 1,$

wherein H is the number of traffic hops and N is the number of nodes (transmission systems) arranged in the loop-shaped transmission network.

FIG. 4 is a schematic view illustrating the flow stream of data and control signals for changing the program in a linear-shaped transmission network according to the preferred embodiment of the present invention.

A process for changing the program and the flow stream of control signal arranged in the linear-shaped transmission network will be described in detail hereinafter with reference to FIG. 4.

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~~The NMS 10 is connected to a transmission system, i.e., NE 1 (21) forming a first node, which is connected to a transmission system, i.e., NE 2 (22) forming a second node, which is also connected to a transmission system, i.e., NE 3 (23) forming a third node. In the event that the NMS 10 attempts to change the program of each node (21), (22), (23), and (24) arranged in the linear-shaped transmission network, the program of the NE 1 (21) is initially changed. Accordingly, the NMS 10 transmits the "program-changing signal" along with the new changing program data to the NE 1 (21). Then, the new changing program data received by the NE 1 (21) is stored in a fixed memory of the NE 1 (21) and the program of the NE 1 (21) is changed to the new changing program data under the control of the "program-changing signal." In this manner, after the program of the NE 1 (21) is changed to the new changing program data transmitted from the NMS 10, the NMS 10 transmits a "program-transmitting signal," or a command signal to the NE 1 (21), dictating the NE 1 (21) to transmit the newly changed program data stored therein to the NE 2 (22) in order to~~

A ~~change the program of the NE 2, while transmitting the "program-changing signal" to the NE 2 (22).~~

Accordingly, when the NE 1 (21) receives the "program-transmitting signal" from the NMS 10, the newly changed program data stored in the memory of the NE 1 (21) is transmitted to the NE 2 (22). Through this process, if the NMS 10 changes the old program data of the NE 2 (22) with the new changing program data, the NMS 10 dictates the NE 1 (21) to transmit the newly changed program data stored in the memory thereof to the NE 2 (22). Thus, the program of the NE 2 (22) can be changed to the new changing program data by having the NMS (21) to transmit the new changing program data stored therein directly to the NE 2 (22), thereby reducing the number of the traffic hops. Also, the process of changing the program data of the NE 2 (22) is identical to the process of changing the program data of the NE 1 (21). Further, the process of changing the program data of the NE 3 (23) can also be performed in similar steps as mentioned in the above process. Accordingly, when the program of a transmission system forming each node is changed to the new changing program data, the number of traffic hops of the nodes arranged in the linear-shaped transmission network can also be expressed by the above-mentioned [formula 3].

As described above, the program changing method of the present invention provides an advantage that in the case where the program of a node forming a network is changed, the newly changed program data is stored in the node. Then, the stored newly changed program

data is transmitted to another node to change the program in the other node, thereby significantly reducing the amount of traffic in the network.

While this invention has been described in connection with what is presently considered to be the most practical and the preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment; on the contrary, it is intended to cover various modifications within the spirit and the scope of the appended claims.